

***Odilia mallomyos* sp. n. (Nematoda: Heligmonellidae) from
Mallomys rothschildi weylandi (Rodentia: Muridae)
of Irian Jaya, Indonesia**

HIDEO HASEGAWA¹ AND SYAFRUDDIN²

¹ Department of Parasitology and Research Center of Comprehensive Medicine, Faculty of Medicine, University of the Ryukyus, Nishihara, Okinawa 903-01, Japan and

² Department of Parasitology, Faculty of Medicine, Hasanuddin University, Ujung Pandang, Indonesia

ABSTRACT: *Odilia mallomyos* sp. n. (Nematoda: Heligmonellidae: Nippostrongylineae) is described based on adults, fourth- and third-stage larvae from the small intestine of *Mallomys rothschildi weylandi* (Rodentia: Murinae) captured around Wamena, Irian Jaya, Indonesia. Adults of this species are distinguished from other members of the genus *Odilia* by the following features: synlophe with continuous ridges (16 in number at midbody of both sexes and the hypertrophied left lateral ridge located about midway between the adjacent ventral and dorsal ridges), spicules with slender pointed tips, bursa copulatrix with a right lobe larger than the left, and absence of gubernaculum. This is the first record of *Odilia* species outside of Australia. Presence of *Odilia* species in Irian Jaya is not unexpected because New Guinea and Australia belong to the same zoogeographical region. The synlophe of adult and fourth-stage larva suggests that *Odilia* is of archaic origin in the subfamily Nippostrongylineae.

KEY WORDS: *Odilia mallomyos* sp. n., Nematoda, *Mallomys rothschildi weylandi*, Murinae, Irian Jaya, Indonesia.

Mallomys rothschildi weylandi Flannery et al. is a giant rat inhabiting montane forests of West New Guinea (Flannery et al., 1989). This murid is hunted for food by the local people. During a survey of murine helminth fauna in 1993, 2 individuals of *M. rothschildi weylandi* were examined, and a nematode belonging to the genus *Odilia* was collected from the small intestine. Close examination has revealed that this species is new to science and is described herein.

Materials and Methods

Two individuals of *M. rothschildi weylandi* were purchased at the central market of Wamena, Irian Jaya, Indonesia. They were dissected and their viscera were fixed and preserved in 10% formalin solution and then transported to the laboratory. The alimentary canals were cut open and examined under a stereomicroscope for nematodes. Collected nematodes were rinsed in 70% ethanol and then cleared with a glycerol–alcohol solution for microscopic examination. In order to study male genital organs, some worms were mounted in chloral-gum. Freehand cross sections were made for observation of the synlophe (Durette-Desset, 1985). Figures were made with the aid of a drawing tube. Measurements (in micrometers unless otherwise stated) are given for the holotype male and the allotype female, followed in parentheses by the range of paratype males and females. Ranges of measurements are given for larval stages. The terminology of the synlophe and female genital organs follows Durette-Desset (1983). Specimens are deposited in the Museum Zoologi Bogor (MZB), Bogor, Indonesia, and the United States National Museum Helminthological Collection (USNM Helm. Coll.), Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland, U.S.A.

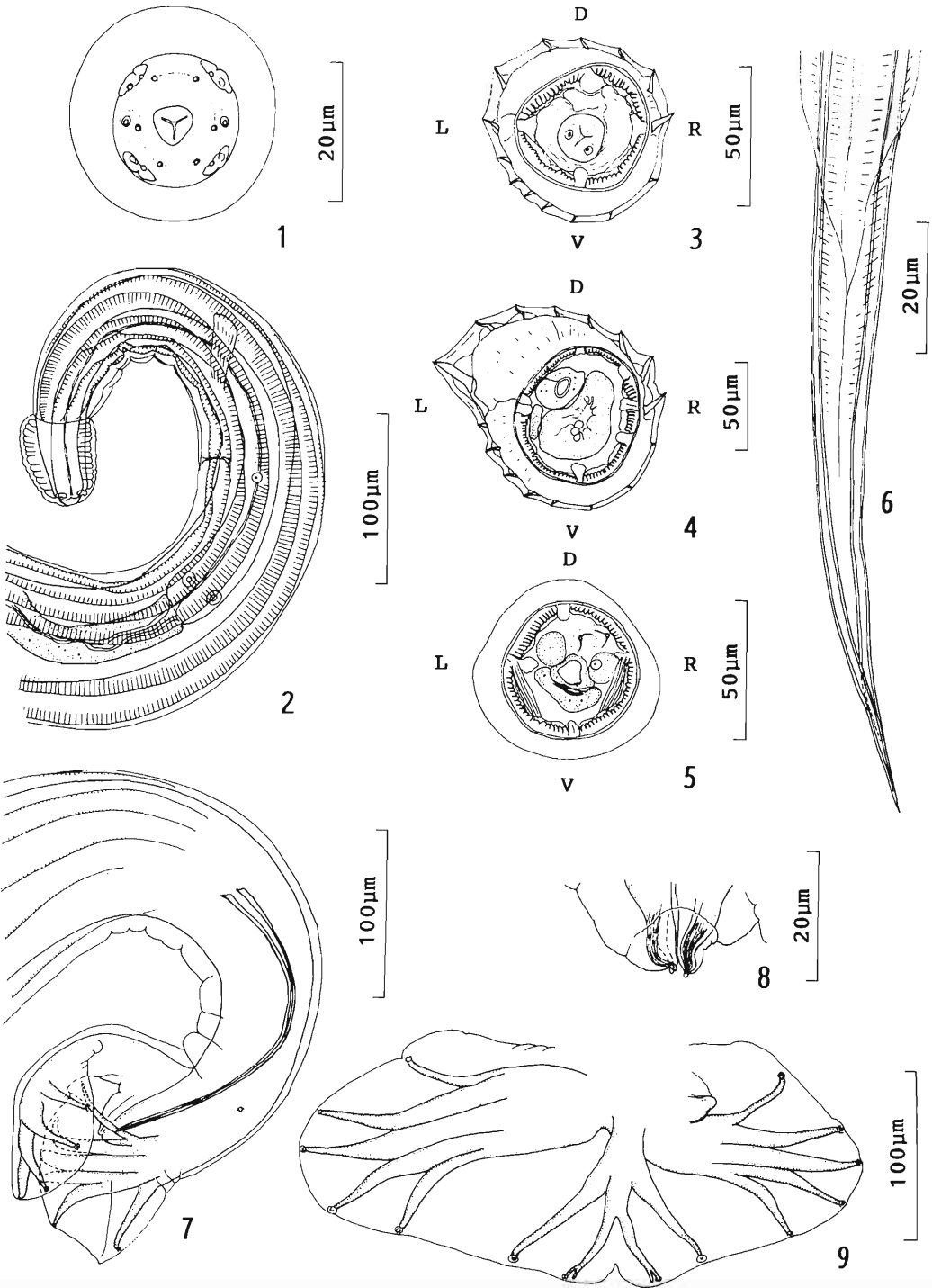
Results

Numerous individuals of a heligmonellid species were found in the upper small intestine of both of the 2 *M. rothschildi weylandi* we examined.

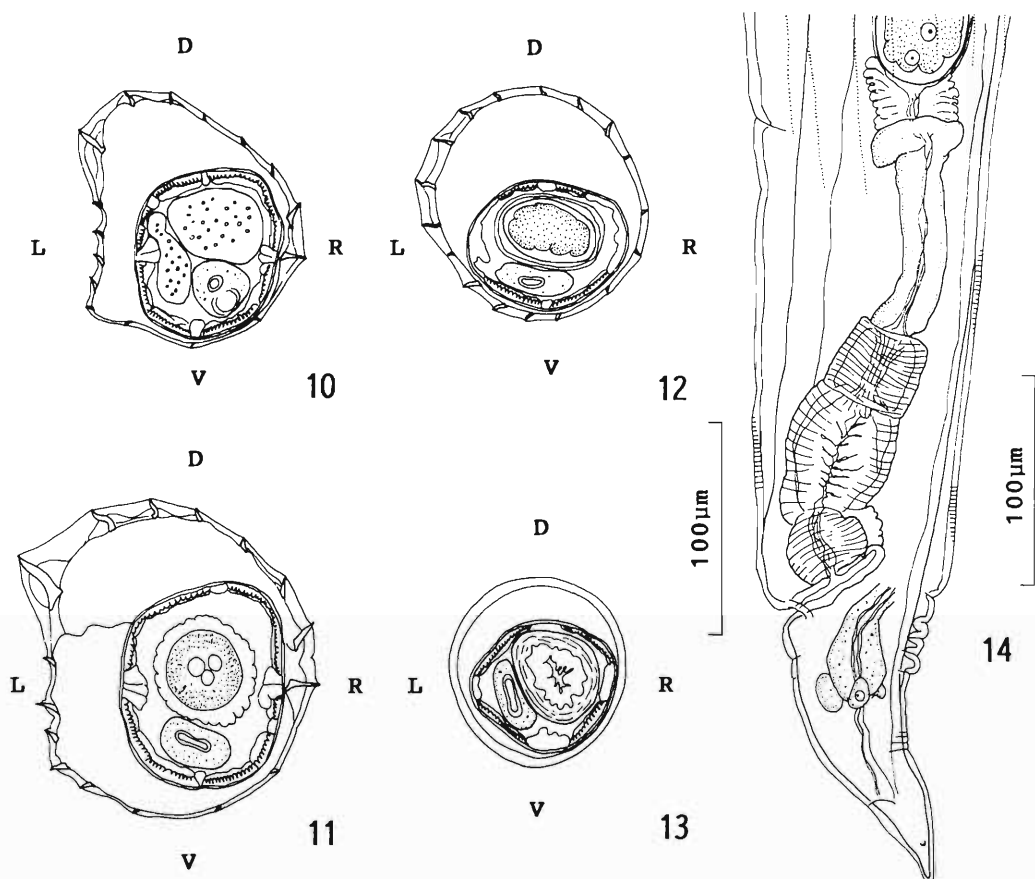
***Odilia mallomyos* sp. n.
(Nematoda: Heligmonellidae:
Nippostrongylineae)**

Adult (Figs. 1–14)

GENERAL: Small worm bent ventrally forming sinistral coils. Cephalic vesicle widening posteriorly, with distinct annulation (Figs. 1, 2). Mouth triangular with rounded corners, and buccal cavity small (Figs. 1, 2). Six minute labial papillae, amphidial pores and 4 double cephalic papillae present (Fig. 1). Cuticle finely striated. Synlophe well developed with pointed ridges, commencing just posterior to cephalic vesicle and ending anterior to level of proximal ends of spicules in male and anterior to level of infundibulum in female (Figs. 2–5, 7, 10–14). Axis of orientation of ridges passing through ventral-right and dorsal-left sides, inclined about 30–40°, 45°, and 70° from sagittal axis in anterior, middle, and posterior body, respectively (Figs. 3, 4, 10–12). In midbody left lateral ridge strongly hypertrophied, located slightly laterodorsally, forming prominent carene of type A; right lateral 2 ridges hypertrophied; dorsal ridges and left ventral ridges moderately developed; ridge just



Figures 1-9. Male adult of *Odilia mallomyos* sp. n. from *Mallomys rothschildi weylandi* of Irian Jaya, Indonesia. 1. Cephalic extremity, apical view. 2. Anterior part of holotype, left lateral view. 3-5. Cross sections through nerve ring (3), midbody (4) and proximal portion of spicules (5). 6. Distal ends of spicules, ventral view. 7. Posterior part of holotype, left lateral view. 8. Genital cone, right lateral view. 9. Bursa copulatrix, ventral view. Abbreviations: D, dorsal; L, left; R, right; V, ventral.



Figures 10-14. Female adult of *Odilia mallomyos* sp. n. from *Mallomys rothschildi weylandi* of Irian Jaya, Indonesia. 10-13. Cross sections through anteriormost portion of intestine (10), midbody (11), uterus (12), and vestibule (13). 14. Posterior part of allotype, left lateral view. Abbreviations: D, dorsal; L, left; R, right; V, ventral.

ventral to hypertrophied left lateral ridge slightly smaller than next ventral ridge; right ventral ridges minute (Figs. 4, 11). In both sexes, 16 ridges present in midbody (Figs. 4, 11); in esophageal region, left lateral 2 ridges and right lateral 2 ridges hypertrophied (Fig. 3); and ridges becoming smaller in posterior body (Fig. 12). Esophagus club-shaped. Nerve ring slightly anterior to middle of esophagus, excretory pore located posterior to middle of esophagus; deirids prominent, at same level with excretory pore (Fig. 2).

MALE (holotype and 10 paratypes): Length 3.7 (3.3-3.9) mm, width at midbody 152 (117-155). Cephalic vesicle 56 (37-53) long by 45 (40-46) wide. Nerve ring 183 (135-190), excretory pore 258 (194-276) and deirids 264 (204-280) from cephalic end. Esophagus 350 (273-376) long and 35 (24-34) wide near posterior end. Bursa

copulatrix markedly asymmetrical with larger right lobe and dorsal incision present (Figs. 7, 9). Prebursal papillae minute (Fig. 7). All bursal rays terminating near bursal rim: ventroventral ray much shorter than lateroventral ray, divergent from each other widely; externolateral and mediolateral rays almost same length, divergent distally; posterolateral ray thinner and shorter than other laterals and divergent from slightly distal to middle of mediolateral ray; dorsal ray and externodorsal rays with common, thick trunk. Dorsal ray divided into 2 divergent branches at middle, and each branch divided again into 2 unequal offshoots near tip; externodorsal ray arising from basal $\frac{1}{3}$ of dorsal ray (Fig. 9). Genital cone moderately protruded, with 1 pair of sessile papillae; anterior lip of cloaca with unpaired papilla (Fig. 8). Spicules relatively short, equal, alate, distal ends fused and pointed, 207 (200-238) long

(occupying 5.5–7.1% of worm length) (Figs. 6, 7). Gubernaculum not observed.

FEMALE (allotype and 10 paratypes): Length 5.2 (4.6–5.2) mm, width at midbody 156 (128–187). Cephalic vesicle 45 (45–50) long by 46 (43–51) wide. Nerve ring 155 (128–158), excretory pore 235 (193–257), and deirids 230 (208–253) from cephalic end. Esophagus 328 (315–360) long and 27 (26–34) wide near posterior end. Vulva 140 (120–158) and anus 44 (38–53) from caudal end (Fig. 11). Postvulval body slightly torsioned to left (Fig. 14). Vagina vera with thick wall forming diverticulum dorsally, 62 (45–64) long, vestibule with compact light-refractive distal portion, 84 (64–84) long, sphincter 35 (26–37) long, and infundibulum usually straight, 120 (104–140) long (Fig. 14). Tail conical, with phasmidial pores subapically (Fig. 14). Eggs ellipsoidal, thin-shelled, containing early cleavage-stage embryos, and 69–77 by 34–45 (Fig. 14).

Fourth-stage larva (Figs. 15–22)

GENERAL: Minute transparent worm bent ventrally forming irregular coils. Cephalic vesicle short, with distinct annulation (Figs. 15, 16). Cuticle posterior to cephalic vesicle with relatively rough annulation and rest of body cuticle with fine transverse striations (Fig. 16). Mouth almost round, and buccal cavity with thick wall (Figs. 15, 16). Six minute labial papillae, amphidial pores and 4 double cephalic papillae present (Fig. 15). Synlophe commencing slightly posterior to cephalic vesicle and ending about 200 from posterior extremity (Figs. 16, 17–19, 22). Axis of orientation of ridges passing through ventral-right and dorsal-left sides, inclined about 25–30° in midbody (Figs. 20, 21). In midbody 10 ridges present in both sexes: 3 dorsal, 5 ventral, and 1 in each lateral side; 1 of dorsal ridges located slightly right to middorsal line less developed lacking clear intracuticular skeleton; lateral and laterodorsal ridges relatively developed; ventral ridges minute (Fig. 20). In midbody of worm with formation of adult cuticle, left ventral 3 ridges becoming hypertrophied with development of some faint additional ridges ventrally (Fig. 21). Esophagus club-shaped (Fig. 16). Nerve ring slightly anterior to middle of esophagus, excretory pore located posterior to middle of esophagus; deirids at same level with excretory pore (Fig. 16).

MALE (10 worms): Posterior end swollen and with terminal process (Figs. 17–19). Length 2.00–2.46 mm, width at midbody 74–93. Cephalic

vesicle 19–40 long by 26–34 wide. Nerve ring 102–128, excretory pore 123–163 and deirids 130–164 from cephalic end. Esophagus 240–320 long and 22–32 wide near posterior end. Various stage of development of bursa copulatrix and spicules seen under cuticle of posterior region (Figs. 17–19). Asymmetry of bursa copulatrix observed from early stage (Fig. 17). Anus hardly discernible in late stage (Fig. 19). Spicules gradually elongated anteriorly (Figs. 17–19). Gubernaculum formation not observed. Tail including terminal process 36–53 long.

FEMALE (8 worms): Posterior end tapering (Fig. 22). Length 1.86–2.69 mm, width at midbody 42–99. Cephalic vesicle 19–32 long by 32–36 wide. Nerve ring 106–117, excretory pore 123–163 and deirids 130–170 from cephalic end. Esophagus 255–303 long and 18–27 wide near posterior end. In premolt larvae, vulva, vagina and ovejector observed under cuticle (Fig. 22). Postvulval body slightly torsioned to left (Fig. 22). Primordial vulva 121–138 from posterior extremity (6 worms). Tail conical, 48–56 long (Fig. 12).

Third-stage larva (Figs. 23–26)

GENERAL (3 worms): Slender transparent larva tapering to both extremities (Figs. 23, 25, 26). Length 0.99–1.23 mm, width at midbody 34–45. Cephalic end round, with submedian papillae and amphidial pores. Cuticle with wide longitudinal elevation in each lateral field having groove with side elevations on lateral line (Figs. 23, 24). Esophagus club-shaped, 265–365 long by 21–22 wide near posterior end; nerve ring just anterior to midesophagus and excretory pore slightly posterior to nerve ring, 110–146 and 135–183, respectively, from anterior extremity (Fig. 23). Deirids not seen. Genital primordium oval, 14–21 long, located ventrally at 380–568 from anterior extremity. Tail with 1 pair of small processes subterminally, 58–62 long (Fig. 25). In premolt worm subterminal processes becoming less prominent (Fig. 26).

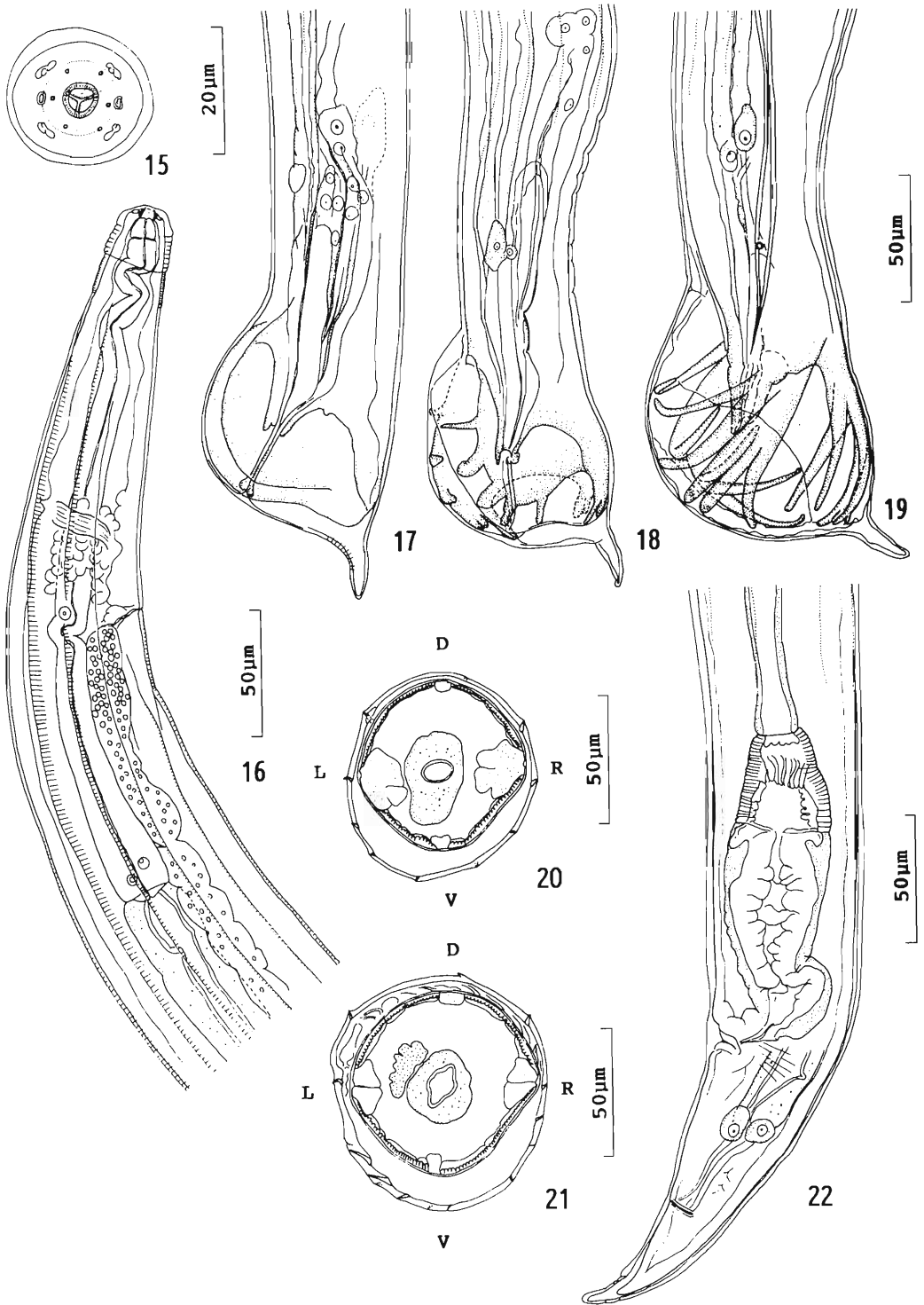
TYPE HOST: *Mallomys rothschildi weylandi* (Muridae: Murinae).

SITE IN HOST: Small intestine (duodenum and upper jejunum).

TYPE LOCALITY: Highland forest near Wamena (4°11'S, 138°58'E; 1,500 m elevation), Irian Jaya, Indonesia.

DATE OF COLLECTION: 4 August 1993.

ETYMOLOGY: Species name is derived from the generic name of the type host.



Figures 15-22. Fourth-stage larva of *Odilia mallomyos* sp. n. from *Mallomys rothschildi weylandi* of Irian Jaya, Indonesia. 15. Cephalic extremity of male, apical view. 16. Anterior part of late fourth-stage male, right lateral view. 17-19. Posterior extremities of males of various developmental stages, left lateral view. 20, 21. Cross sections through midbody of early fourth-stage male (20) and late fourth-stage male (21). 22. Posterior part of female, left lateral view. Abbreviations: D, dorsal; L, left; R, right; V, ventral.

TYPE SPECIMENS: MZB Na-274 (holotype and allotype); MZB Na-275 (5 male and 5 female paratypes), USNM Helm. Coll. 83732 (5 male and 5 female paratypes, 10 male and 8 female fourth-stage larvae, and 3 third-stage larvae).

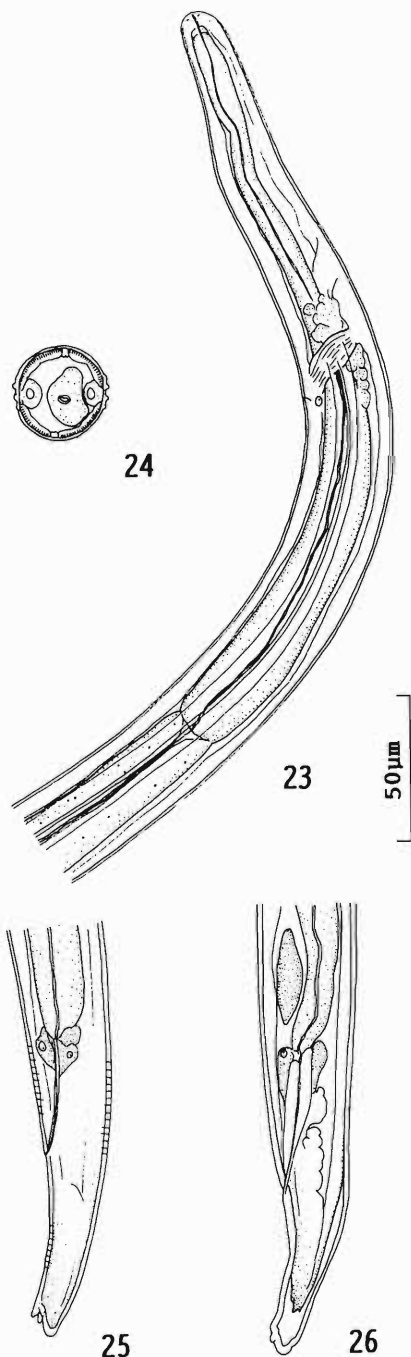
REMARKS: The present species belongs to the genus *Odilia* Durette-Desset, 1973 (syn. *Austrostrongylus* sensu Durette-Desset, 1971 nec Chandler 1927) because the left lateral ridge of synlophe in midbody of adult is hypertrophied, supporting carene of type A, the bursa copulatrix is asymmetrical, and the externodorsal rays are of the same size (Durette-Desset, 1971, 1983). *Odilia mallomyos* is unique because the gubernaculum is apparently lacking. All other representatives of this genus have readily discernible gubernaculum (Mawson, 1961; Durette-Desset, 1969).

Odilia mallomyos is easily distinguished from *Odilia polyrhabdote* (Mawson, 1961), and *Odilia mawsonae* (Durette-Desset, 1969) because in the latter 2 species there are more than 20 synlophe ridges in the midbody and the left lateral ridge is not hypertrophied (Durette-Desset, 1969). *Odilia mallomyos* is also easily distinguished from *Odilia uromyos* (Mawson, 1961) because the latter species has numerous (more than 40) ridges at the widest portion of its body (Mawson, 1961). The present species resembles *Odilia brachybursa* (Mawson, 1961), *Odilia mackerrasae* (Mawson, 1961), *Odilia emanuelae* (Mawson, 1961), and *Odilia melomyos* (Mawson, 1961). However, *O. brachybursa* has spicules that are expanded near the tips into 2 alate branches, *O. mackerrasae* has intermittent ridges in the ventral field, and *O. emanuelae* has a larger left lobe in the bursa copulatrix, all being readily distinguished from the present species (Mawson, 1961; Durette-Desset, 1969).

The synlophe of *O. melomyos* is similar to that of the present species although it has 15 ridges in the anterior body and midbody (Durette-Desset, 1969). Nevertheless, *O. melomyos* is distinguishable from *O. mallomyos* because the left lateral hypertrophied ridge is much closer to the adjacent ventral ridge than to the adjacent dorsal ridge and in having much longer spicules (over 350 long in the males with body length of 3.4–3.5 mm) (Mawson, 1961; Durette-Desset, 1969).

Discussion

The nematodes of the genus *Odilia* have been known only from Australia (Durette-Desset,



Figures 23–26. Third-stage larva of *Odilia mallomyos* sp. n. from *Mallomys rothschildi weylandi* of Irian Jaya, Indonesia. 23. Anterior part, left lateral view. 24. Cross section of midbody. 25, 26. Posterior extremity of early (25) and late (26) third-stage larvae, left lateral view.

1971, 1973, 1985; Obendorf, 1979; Smales, 1992). Thus this report is the first of an *Odilia* species outside of Australia. No description has been made of *Odilia* species larval stages. Durette-Desset (1985) presented a hypothesis that the ancestral *Odilia* was introduced to Australia from Southeast Asia by *Melomys*-group murines during lower and middle Pliocene from which they subsequently speciated. The presence of an *Odilia* species in New Guinea is not unexpected because this large island zoogeographically belongs to the Australian Region and many murines including *Melomys* and *Uromys* are shared by both Australia and New Guinea (cf. Musser and Carleton, 1993).

Durette-Desset (1985) recognized 2 groups in the synopse of the fourth-stage larva of Nippostrongylineae. It is apparent that *O. mallomyos* belongs to the second group because it has a ridge directly adjacent to the left lateral chord (Durette-Desset, 1985). Its synopse resembles those of *Neoheligionella* and *Heligionoides* in having a total of 10 ridges of which 3 are in the dorsal side (Durette-Desset, 1985). However, *O. mallomyos* is closer to *Nippostrongylus* than to *Neoheligionella* or *Heligionoides* in the degree of inclination of the axis of synopse orientation with respect to the sagittal axis. It inclines more than 50° from the sagittal axis in the fourth-stage larva of *Neoheligionella* and *Heligionoides*, while in *Nippostrongylus* it inclines less than 50° (Durette-Desset, 1985, Fig. 7).

It has been considered that the axis of orientation has rotated from sagittal to frontal during the course of Nippostrongylineae evolution (Durette-Desset, 1985). The synopse of the fourth-stage larva and adult of *O. mallomyos* suggests that the genus *Odilia* is an early derivative from a common evolutionary stem with *Neoheligionella* and *Heligionoides*. The fact that only *Odilia* and *Nippostrongylus* have been known as intestinal nippostrongyline in Australian region may indicate that these genera have archaic origins in this subfamily.

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